

Some radulae and opercula from West African Nassariidae (Mollusca: Neogastropoda)

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ABSTRACT. The radulae and opercula of some species of the family Nassariidae are shown in drawings. Most of them have not previously been illustrated. Differential characters are commented on in the text. Shells of the studied species are also figured.

INTRODUCTION

Adam & Knudsen (1984) wrote a revision of the Nassariidae from West Africa and illustrated many radulae and opercula from this family. Some species were not represented because they had not yet been described, or in other cases probably because the authors did not have enough material or only dead material. In the present work, we illustrate some of these missing opercula and radulae in addition to the shells.

Material and Methods

Most of the studied material was collected by the late Francisco Fernandes for a revision of West African Nassariidae which he had planned to produce. But the death of Francisco stopped those projects. During the last several years, I was able to add more species to that material and finally, decided to present those radulae and opercula as a complement to the work of Adam & Knudsen (1984).

Each species was prepared by employing 1-5 specimens from those we were able to obtain. This number is indicated in the description as N (number of specimens studied). The shells were dissolved in a solution of 5% HCl. The operculum was separated after that and the soft parts were added to water, and dissolved by adding Na(OH) (between 5 and 30% depending on size). The radula was observed under magnification, placed on a slide and broken for a better observation of the teeth. Finally, it was fixed by Eukitt. The teeth were drawn from a light camera, using a phase contrast microscope. In the illustrations the radulae are in a position different from that one used in Adam & Knudsen (1984) because this presentation appears to be the most usual form of showing such drawings (see Bandel, 1984). We did not give a complete description of the radulae

because they are self-evident in the drawings. Only short comments on some special characters are listed. The opercula were drawn directly from a stereo microscope. The opercula correspond to the specimens whose radula was studied. Some of them present fractures or were eroded in some parts. We drew them in their actual condition. In the last plate we show shells of the species whose radula was studied.

The species studied were the following:

SYSTEMATICS

Family NASSARIIDAE Iredale, 1916

Genus *Nassarius* Duméril, 1806

Type species: *Buccinum arcularia* L., 1758, by subsequent modification. Recent, Indo-Pacific.

Nassarius adami Arthur & Fernandes, 1989
Figs 1, 17, 32

Radula: (Fig. 1) N = 3. Number of teeth about 70-80. The shorter cusp of the marginal teeth is unusually large and wide.

Operculum: (Fig. 17) Border smooth.

Nassarius n. sp. Rolán & Hernández (in press)
Figs 2, 18, 33

Radula: (Fig. 2) N = 2. Number of teeth about 70. Operculum: (Fig. 18) Several prominences are evident on both borders.

Remarks: The original description (Rolán & Hernández, in press) did not show the radula and operculum because it was supposed to be illustrated in Adam & Knudsen (1984) under the name of *N. desmoulioides*. As we are not sure about which

specimen was studied by those authors, we now present a drawing of this radula.

Nassarius caboverdensis (Rolán, 1984)
Figs 3, 19, 34

Radula: (Fig. 3) N = 3. Number of teeth about 60. A small intermediate lateral accessory plate is present. Operculum: (Fig. 19) Prominences are unusual. Remarks: Shells of this species were known by Adam & Knudsen (1984), but they considered them to be *N. cuvierii* (Payraudeau, 1826). In the description of *N. caboverdensis* (Rolán, 1984) the radula was not illustrated.

Nassarius heyneimanni (von Maltzan, 1884)
Figs 4, 20, 35

Radula: (Fig. 4) N = 1. Number of teeth about 50. Operculum: (Fig. 20). Transparent, rather irregular with short prominences. Soft parts: Examined in two specimens from Dakar: animal whitish with the extreme of the siphon brown-greyish, through the operculum two black lines forming a "Y" can be seen.

Nassarius liberiensis (Knudsen, 1956)
Figs 5, 21 36

Radula: (Fig. 5) N = 2. Number of teeth about 70. A curious radula with a very short central tooth with only 4, occasionally 5 cusps. In spite of this short tooth, the general characters are preserved. The marginal is very large, being the most prominent cusp, large and wide basally. Operculum: (Fig. 21) Rather regular.

Nassarius megalocallus Adam & Knudsen, 1984
Figs 6, 22, 37

Radula: (Fig. 6) N = 2. Number of teeth about 56. The marginal teeth have the smaller cusp very narrow and at the extreme end. Operculum: (Fig. 22) It seems to be eroded in the internal border.

Nassarius pachychilus (von Maltzan, 1884)
Figs 7, 23, 38

Radula: (Fig. 7) N = 1. Number of teeth about 64. Central tooth is relatively short and the posterior corners rather prominent. The lateral teeth have the smaller cusp short, and at the extreme end. Operculum: (Fig. 23) Yellowish, little transparent.

Nassarius plebejus (Thiele, 1925)
Figs 8, 24, 39

Radula: (Fig. 8) N = 2. Number of teeth about 60-66. A small intermediate lateral accessory plate is present. The central tooth has the posterior corners elongate and strong. Operculum: (Fig. 24) Yellowish, internal border serrated.

Nassarius pseudopoecilostictus
Adam & Knudsen, 1984
Figs 9, 25, 40

Radula: (Fig. 9) N = 1. Number of teeth about 75. Central tooth relatively narrow and the posterior corner elongated and pointed. Operculum: (Fig. 25) Rather similar to the previous species.

Nassarius pumilio (Smith, 1872)
Figs 10, 26, 41

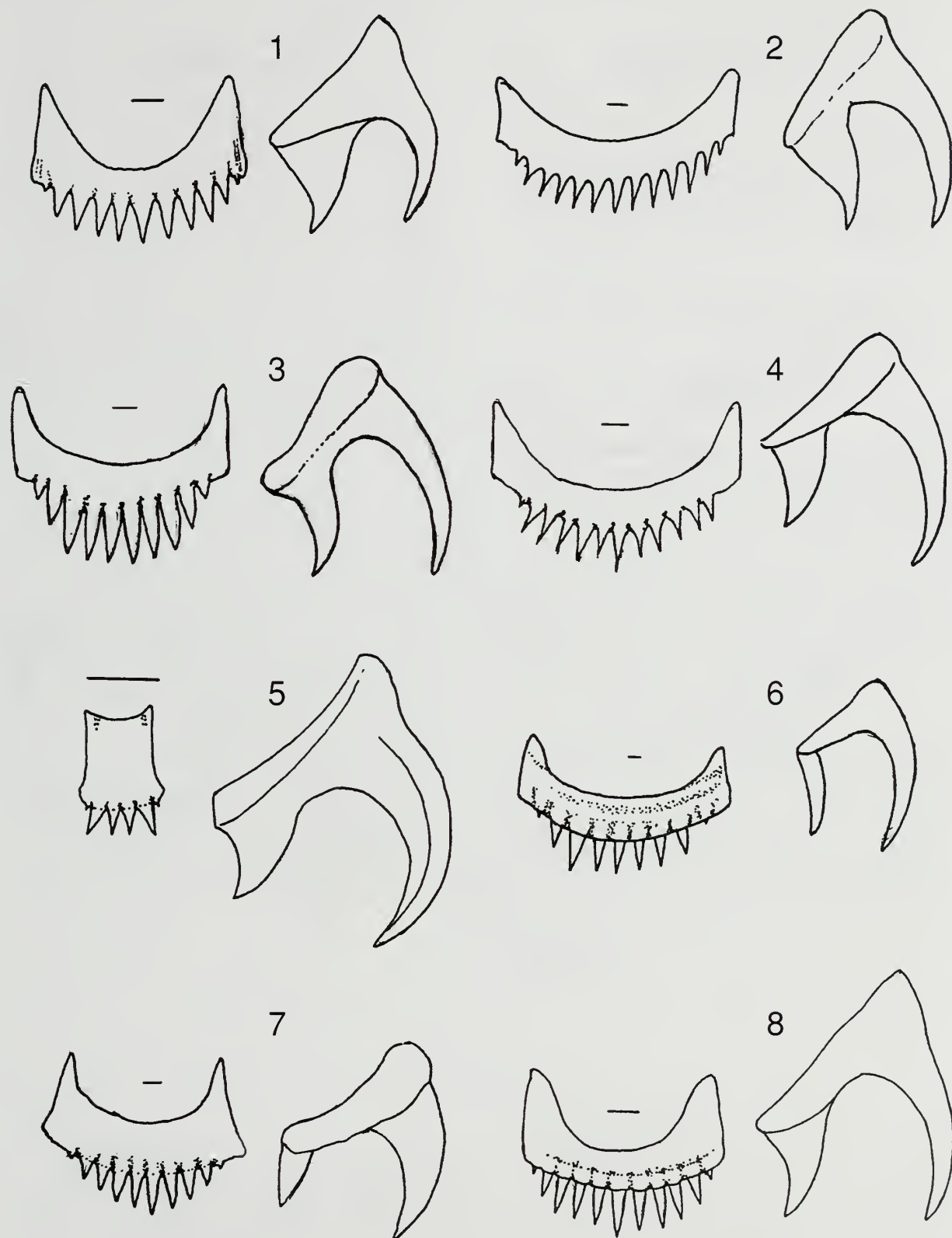
Radula: (Fig. 10) N = 3. Number of teeth about 70-80. Lateral with posterior corner wide and elongate. Operculum: (Fig. 27) Very fine, translucent, with a slight axial depression.

Nassarius sesarmus (Marrat, 1887)
Figs 11, 27, 42

Radula: (Fig. 11) N = 1. Number of teeth about 70. Central cusp narrow at its middle part with elongate posterior corners. The cusps are irregular, the outermost being very small. Operculum: (Fig. 26) Almost transparent with a slight axial depression.

Figures 1-8. Radulae (scale bar 0.01 mm)

1. *Nassarius adami* Arthur & Fernandes, 1989, shell of 10.3 mm, Corimba, Luanda, Angola, 20 m; 2. *Nassarius* n.sp. Rolán & Hernández (in press), shell of 21.3 mm, off Mauritania, 150 m; 3. *Nassarius caboverdensis* (Rolán, 1984), shell of 12.8 mm, Sal, Cape Verde Is., 8 m; 4. *Nassarius heyneimanni* (von Maltzan, 1884), shell of 8.6 mm, Dakar, Senegal, 28 m; 5. *Nassarius liberiensis* (Knudsen, 1956), shell of 5.8 mm, Cacucaco, Luanda, Angola, 1 m; 6. *Nassarius megalocallus* Adam & Knudsen, 1984, shell of 10.0 mm, off Luanda, Angola, 100 m; 7. *Nassarius pachychilus* (von Maltzan, 1884), shell of 17.4 mm, Cacucaco, Luanda, Angola, 2-3 m; 8. *Nassarius plebejus* (Thiele, 1925), shell of 12.1 mm, Palmeirinhas, Angola, 15 m.



Genus *Demoulia* Gray, 1838

Type species by subsequent designation: *Buccinum retusum* Lamarck, 1822 = *Nassa ventricosa* Lamarck, 1816. Recent, South Africa.

Demoulia nataliae Kilburn, 1975

Figs 12, 43

Radula: (Fig. 12). N = 3. Number of teeth about 80. The marginal teeth have both cusps very narrow and elongated, smaller one being almost of the same size as the larger one. The posterior corners of the central tooth elongate.

Operculum: The drawing of the operculum was lost.

Genus *Adinopsis* Odhner, 1923

Type species by monotypy *Phos bellaliratus* Gabb, 1861. Eocene of Alabama, USA.

Adinopsis skoogi Odhner, 1923

Figs 13, 28, 44

Radula: (Fig. 13) N = 1. Number of teeth about 90. The central tooth has a thickening along it and the posterior corners are strong and elongate.

Operculum: (Fig. 28) Brown, barely transparent.

Genus *Bullia* Gray in Griffith & Pidgeon, 1834

Type species by monotypy *Bullia semiplicata* Gray in Griffith & Pidgeon, 1834 = *Buccinum callosum* Wood, 1828. Recent, South Africa.

Bullia turrita Gray, 1839

Figs 14, 29, 45

Radula: (Fig. 14) N = 5. Number of teeth about 80. Marginal teeth with numerous cusps and elongate posterior corners.

Operculum: (Fig. 29)

Remarks: The radula and the operculum of this species were figured in Rolán & Fernandes (1997), but we repeat them here.

Genus *Cyllene* Gray in Griffith & Pidgeon, 1834

Type species by monotypy *Cyllene owenii* Gray in Griffith & Pidgeon, 1834. Recent, West Africa.

Cyllene cernorhorskyi Fernandes & Rolán, 1992

Figs 15, 30, 46

Radula: (Fig. 15) N = 2. The radula was studied from a paratype in the collection of the author. Number of teeth about 60. The marginal teeth have the short cusp very small and the basal thickening not elongated, as is usual in this family.

Operculum: (Fig. 30) It was not figured in the description. It is thin, almost smooth and transparent.

Remarks: The radula of *Cyllene lamarcki* Cernohorsky, 1975 was shown in Thiele (1929, p. 326, as *C. lyrata*) and in Adam & Knudsen (1984). The present radula is the second species illustrated for the genus *Cyllene*. It is a little different from those of *C. lamarcki* and *C. owenii* (see below) because the basal thickening of the marginal tooth is more prominent.

Cyllene owenii Gray, 1834

Figs 16, 31, 47

Radula: (Fig. 16) N = 2. Number of teeth about 77. The marginal teeth characteristic for the genus.

Operculum: (Fig. 31) Transparent, borders smooth.

Remarks: All the studied species of the genus *Cyllene* have a radula with marginal teeth with only one elongate cusp, with the shorter cusp very small, almost vestigial.

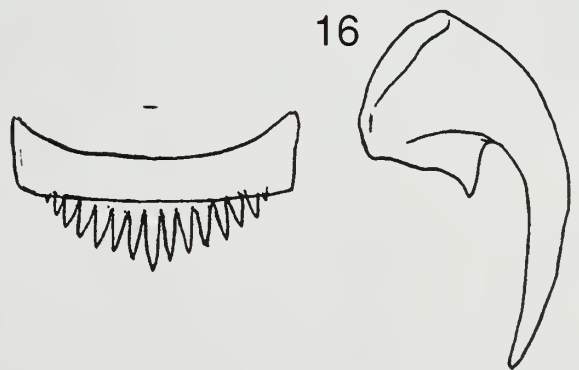
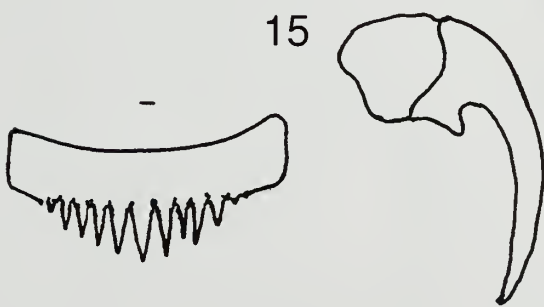
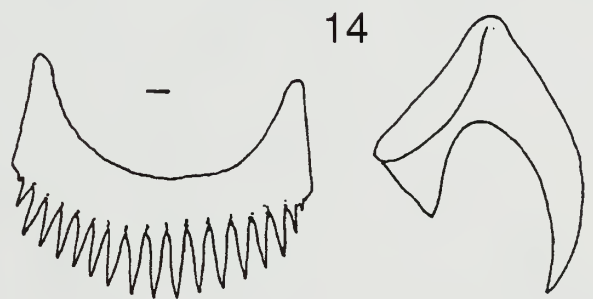
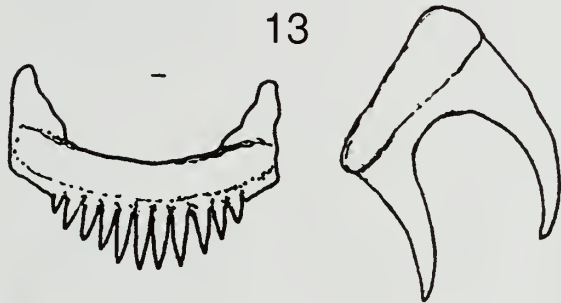
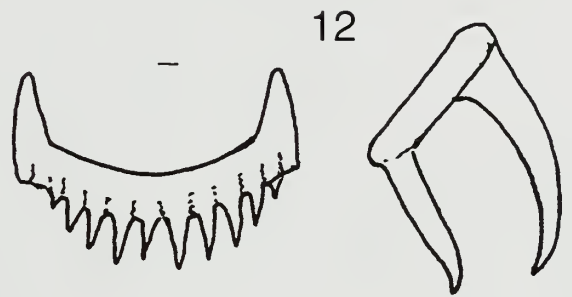
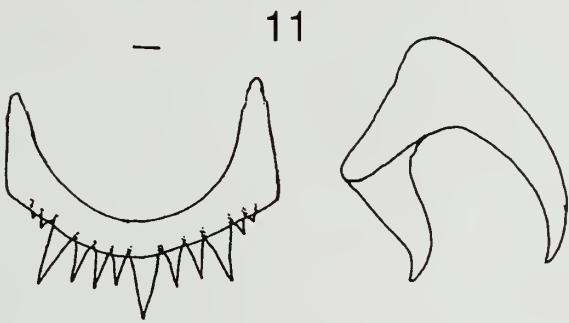
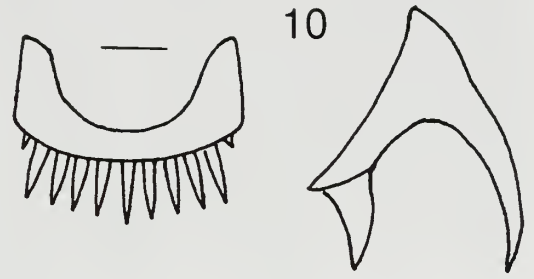
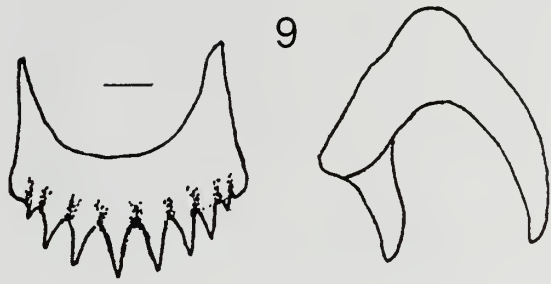
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Figures 9- 16. Radulae (scale bar 0.01 mm)

9. *Nassarius pseudopocilostictus* Adam & Knudsen, 1984, shell of 10.6 mm, Praia Amelia, Angola, 2-3 m; 10. *Nassarius pumilio* (Smith, 1872), shell of 3.2 mm, N Luanda, Angola, low tide; 11. *Nassarius sesarmus* (Marrat, 1887), shell of 12.3 mm, Corimba, Luanda, Angola, 20 m; 12. *Demoulia nataliae* Kilburn, 1975, shell of 23.0 mm, Sacomar, Angola, 2 m; 13. *Adinopsis skoogi* Odhner, 1923, shell of 31.9 mm, Namibe, Angola, 20 m; 14. *Bullia turrita* Gray, 1839, shell of 25.0 mm, Busua, Ghana, intertidal; 15. *Cyllene cernorhorskyi* Fernandes & Rolán, 1992, shell of 8.5 mm, Palmeirinhas, Angola, 10-20 m; 16. *Cyllene owenii* Gray, 1834, shell of 13.9 mm, Cacucaco, Luanda, Angola 10-20 m.



REFERENCES

- Adam, W. & Knudsen, J. 1984. Revision des Nassariidae (Mollusca: Gastropoda Prosobranchia) de l'Afrique occidentale. *Bulletin Institut royal des Sciences naturelles de Belgique, Biologie*, 55 (9): 1-95, 5 pls.
- Bandel, K. 1984. The radulae of Caribbean and other Mesogastropoda and Neogastropoda. *Zoologische Verhandelingen*, 214: 1-188, 22 pls.
- Rolán, E. 1984. Descripción de una nueva especie del género *Hinia* Leach in Gray, 1847 (Mollusca, Gastropoda) procedente del Archipiélago de Cabo Verde. *Bolletino Malacologico*, 20 (5-8): 167-174.
- Rolán, E. & Fernandes, F. 1997 ("1996"). A poorly known species from Ghana, *Bullia turrata* Gray, 1839. *La Conchiglia*, 28 (281): 57-60.
- Rolán, E. & Hernández, J. M. (in press). The West African species of the group *Nassarius denticulatus* (Mollusca, Neogastropoda), with the description of a new species. *Journal of Conchology*.
- Thiele, J. 1929. *Handbook of Systematic Malacology. Part 1 (Loricata, Gastropoda: Prosobranchia)*. G. Fischer, Stuttgart. 625 pp.

Figures 17-31. Opercula

17. *Nassarius adami*, 1.6 mm; 18. *Nassarius* n.sp. (in press), 5.1 mm; 19. *Nassarius caboverdensis*, 3.8 mm; 20. *Nassarius heynemanni*, 2.9 mm; 21. *Nassarius liberiensis*, 1.6 mm; 22. *Nassarius megalocallus*, 3.0 mm; 23. *Nassarius pachychilus*, 4.2 mm; 24. *Nassarius plebejus*, 3.1 mm; 25. *Nassarius pseudopoeecilostictus*, 3.3 mm; 26. *Nassarius pumilio*, 1.2 mm; 27. *Nassarius sesarmus*, 2.9 mm; 28. *Adinopsis skoogi*, 7.3 mm; 29. *Bullia turrata*, 4.2 mm; 30. *Cyllene cernorhorsky*, 3 mm; 31. *Cyllene owenii*, 5.5 mm.



Figures 32-47. Shells

32. *Nassarius adami*, 8.5 mm, Corimba, Luanda, Angola, 20 m; **33.** *Nassarius* n.sp. (in press), 25.1 mm, off Mauritania; **34.** *Nassarius caboverdensis*, 16.0 mm, Praia Aeroporto, São Vicente, Cape Verde Is., 12 m; **35.** *Nassarius heynemanni*, 8.6 mm, Dakar, Senegal, 28 m; **36.** *Nassarius liberiensis*, 6.3 mm, Cacuaco, Luanda, Angola, 1 m; **37.** *Nassarius megalocallus*, 10.3 mm, off Luanda, Angola, 100 m; **38.** *Nassarius pachychilus*, 17.4 mm, Cacuaco, Luanda, Angola, 2-3 m; **39.** *Nassarius plebejus*, 11.8 mm, Palmeirinhas, Angola, 15 m; **40.** *Nassarius pseudopocilostictus*, 10.1 mm, Praia Amelia, Angola, 2-3 m; **41.** *Nassarius pumilio*, 3.3 mm, Santiago, N Luanda, Angola, low tide; **42.** *Nassarius sesarmus*, 10.8 mm, Corimba, Luanda, Angola, 20 m; **43.** *Demonilia nataliae*, 23.0 mm, Sacomar, Angola, 2 m; **44.** *Adinopsis skoogi*, 31.9 mm, Namibe, Angola, 20 m; **45.** *Bullia turrita*, 16.3 mm, Busua, Ghana, intertidal; **46.** *Cyllene cernorhorsky*, paratype, 8.5 mm, Palmeirinhas, Angola, 10-20 m; **47.** *Cyllene owenii*, 11.8 mm, Byoko, Guinea Equatorial 10 m.

